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Variation in readmission expenditures after high-risk surgery

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ABSTRACT

Background: The Hospital Readmissions Reduction Program reduces payments to hospitals with excess readmissions for three common medical conditions and recently extended its readmission program to surgical patients. We sought to investigate readmission intensity as measured by readmission cost for high-risk surgeries and examine predictors of higher readmission costs.

Materials and methods: We used the Healthcare Cost and Utilization Project's State Inpatient Database to perform a retrospective cohort study of patients undergoing major chest (aortic valve replacement, coronary artery bypass grafting, lung resection) and major abdominal (abdominal aortic aneurysm repair [open approach], cystectomy, esophagectomy, pancreatectomy) surgery in 2009 and 2010. We fit a multivariable logistic regression model with generalized estimation equations to examine patient and index admission factors associated with readmission costs.

Results: The 30-d readmission rate was 16% for major chest and 22% for major abdominal surgery ($P < 0.001$). Discharge to a skilled nursing facility was associated with higher readmission costs for both chest (odds ratio [OR]: 1.99; 95% confidence interval [CI]: 1.60-2.48) and abdominal surgeries (OR: 1.86; 95% CI: 1.24-2.78). Comorbidities, length of stay, and receipt of blood or imaging was associated with higher readmission costs for chest surgery patients. Readmission >3 wk after discharge was associated with lower costs among abdominal surgery patients.

Conclusions: Readmissions after high-risk surgery are common, affecting about one in six patients. Predictors of higher readmission costs differ among major chest and abdominal

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surgeries. Better identifying patients susceptible to higher readmission costs may inform future interventions to either reduce the intensity of these readmissions or eliminate them altogether.

Introduction

On October 1, 2012, the Centers for Medicare and Medicaid Services enacted the Hospital Readmissions Reduction Program, which reduces payments to hospitals with excess readmissions for three common medical conditions (acute myocardial infarction, heart failure, and pneumonia).[1] Centers for Medicare and Medicaid Services recently extended its readmission program to surgical patients and plans to include high-risk procedures, such as cardiac surgery, in the near future.[2,3] Currently, excess readmissions are calculated by accounting for patient factors, such as age, gender, and comorbidities, in its risk adjustment.[4]

However, the Hospital Readmissions Reduction Program does not account for differences in the readmission intensity (i.e., the cost associated with the readmission), which may be important to consider when assessing readmissions after high-risk surgery. Recent work has demonstrated that the quality of hospital care is only marginally associated with surgical readmission rates.[5] The inability to detect a relationship between quality and readmissions after surgery may be due to the fact that not all surgical readmissions are the same. On the one hand, readmissions for acute complications may save lives by averting a catastrophic "failure to rescue" event.[6] On the other hand, readmissions for inadequate social support may be avoided with better allocation of resources.[7] Yet, the current Hospital Readmissions Reduction Program does not account for these differences in hospital readmissions; the program focuses on whether or not a readmission occurs without considering the context of the readmission. In part, this may be attributed to the limited information regarding the intensity of the readmission, especially for patients undergoing high-risk surgery.

For these reasons, we performed a study to evaluate readmission intensity as measured by readmission costs for patients undergoing major chest (aortic valve replacement [AVR], coronary artery bypass grafting [CABG], lung resection) and abdominal surgery (abdominal aortic aneurysm [AAA] repair, cystectomy, esophagectomy, pancreatectomy). A better understanding of the variation in readmission cost associated with these high-risk surgeries may help inform policies aimed at improving the quality and cost of surgical care.

Methods

Data source and study population

We used the Healthcare Cost and Utilization Project's State Inpatient Database for New York, Iowa, North Carolina, and Washington to identify adult men and women (18 y or older) who underwent one of seven high-risk surgeries in 2009 or 2010. The State Inpatient Database provides information about hospital inpatient stays and patient-level discharge data for 97% of all United States' community hospital discharges.[8] We chose these four states because they comprise diverse patient and geographic populations and because they have data available to characterize readmissions. The seven high-risk surgery types included AAA repair (open as opposed to endovascular approach), CABG, AVR, esophagectomy, pancreatectomy, lung resection, and cystectomy. We chose these surgeries because they represent complex operations with high readmission rates (all >10%).[5,9,10]

We identified patients undergoing these seven high-risk surgery types using their respective International Classification of Diseases, ninth Revision, Clinical Modification (ICD-9-CM) codes (Appendix). Patients who underwent two or more of the designated surgeries were excluded unless they received both a CABG and an AVR, in which case they were identified as having an AVR; 46% of patients undergoing an AVR had a concomitant CABG. Using these criteria, our study consisted of 69,321 patients.

Outcomes

The objective of this study was to assess readmission costs among patients undergoing high-risk surgery. First, we defined a readmission as a hospital admission within 30 d of the index surgery. We used a 30-d period to be consistent with the readmission definition used by the Hospital Readmissions Reduction Program.[1] Then, we examined readmission cost as our primary outcome. Specifically, we calculated readmission costs using an established method[11,12] based on total readmission charges and hospital-specific cost-to-charge ratios developed by the Healthcare Cost and Utilization Project.[8] The cost-to-charge ratio provides a way to estimate the cost of hospital services, as opposed to the charges put forth by hospitals. Readmission costs were then ranked and sorted into quartiles.

Statistical analysis

We first compared patient demographics and index admission characteristics among patients undergoing one of the seven major surgery types, according to whether or not they were subsequently readmitted. Continuous variables were compared using Student *t*-tests. Nominal and ordinal categorical variables were compared using general chi-squared and Mantel-Haenszel chi-squared tests, respectively. Next, we focused on the patients who were readmitted and compared characteristics related to their readmission, such as time to readmission, length of stay, discharge disposition, and cost. For this part of the analysis, we distinguished chest (CABG, AVR, lung resection) from abdominal (AAA, esophagectomy, pancreatectomy, cystectomy) surgery to account for the different sets of risks and convalescence periods